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Appendix E

Post-ROD XRF Surveying Results for Lead Contamination

ENGINEERING DESIGN FILE

1. Project File No.: NA 2. Project/Task: OU-CF-10

3. Subtask: NA

4. Title: X-Ray Fluorescence Survey of CFA-010 Transformer Yard for Lead (Pb) in Surface Soil.

5. Summary:

Portage Environmental was contracted to perform a survey of the Transformer Yard utilizing a Niton X-Ray Fluorescence (XRF) instrument in the areas within the fenced Transformer Yard and contiguous to the fence on the outside of the yard. The survey was performed in October 2000. The initial XRF survey design was documented in the "Data Collection Plan for the X-Ray Fluorescence Spectrometer Survey at Waste Area Group (WAG) 4 Operable Unit (OU) 4-09 Site CFA-10" (10/13/2000 Draft). This plan documented a statistical sampling design to identify circular hot spots, with an area of one square foot. The survey was performed to bound the contaminated areas. The survey was not completed in the Northeast section of the yard due to limitation in project resources, caused in part by inaccurate estimates of the time required to complete individual survey points, but information collected indicate zones of high contamination and patterns for contamination location. Results of the survey as completed are presented in this EDF.

6. Distribution (complete package): H. D. Williams, MS 3953; D.J. Wiggins, MS 3953;

Distribution (summary package only):NA

7. Review (R) and Approval (A) Signatures:
(Minimum reviews and approvals are listed. Additional reviews/approvals may be added.)

	R/A	Typed Name/Organization	Signature	Date
Performer	R	Lorin N Clements, Portage Environmental	Lorin N Clements	12/19/2000
Independent Reviewer	R	Cliff Watkins, Portage Environmental	Cliff Watkins	12/19/2000
Requestor	A	Alan Propp, BBWI WAG4	Alan Propp	12/19/2000
Approver	A			

Contents

Figures

Acronyms

AA	Alternative Action
CFA	Central Facilities Area
DS)	Decision Statement
OU	Operable Unit
PRG	preliminary remediation goal
PSQ	principal study question
RI/FS	Remedial Investigation/Feasibility Study
RESL	Radiological and Environmental Sciences Laboratory
WAG	Waste Area Group

1. Introduction

The X-ray fluorescence (XRF) survey was performed at the Waste Area Group (WAG) 4 Operable Unit (OU) 4-09, building CFA-667, Transformer Yard as part of an effort to determine the best options for remedial design activities. During the activities documented in the Comprehensive Remedial Investigation/Feasibility Study (RI/FS) for the Central Facilities Area (CFA)[1], 13 samples were collected from the yard in four locations to determine the potential for hazardous constituents at various depths and their concentrations, if present. These samples were taken to represent depths of 0 to 0.5, 1.0, and 2.0 ft at each location. Figure 3-5 of the RI/FS report identifies the estimated locations of the samples. Additional analytical data collected during 1997 and 1998 (a total of eight [8] locations) indicate that the surface soils from 0 to 0.5ft (0 to 0.15 m) below the grade surface have lead concentrations ranging from 16.5 to 5,560 mg/kg. It was postulated in the RI/FS report that the full extent of contamination would possibly be greater than just the sample locations because no specific pattern of welding activities or waste disposal of scrap lead in the yard could be identified.

The WAG 4 Manager contracted, Contract K00-583020, Task No. 28—XRF Survey[2], Portage, Environmental, Inc., to perform an XRF survey in the yard. The low number of samples collected in the yard during RI/FS activities was not sufficient to identify the boundaries of the area of contamination. WAG 4 Management was concerned about the potential for windblown contamination to be present beyond the fenced area of the yard. During remedial design, questions arose about the extent of the surface area requiring remediation. Of specific concern was whether excavation of the area to a depth of six inches to remove the contamination was required or if this would represent an over excavation. A summary of the objectives established by Portage, in the Data Collection Plan for the XRF Spectrometer Measurement Survey at WAG 4 OU 4-09 Site CFA-10[3], in consultation with WAG 4 personnel for the XRF survey is provided.

2. Data Quality Objectives

The data quality objectives established in the survey plan included establishment of a principal study question. (PSQ):

- PSQ: Using XRF spectrometer data, what is the extent of surface contamination that exceeds the preliminary remediation goal (PRG) of 400 mg/kg?

The Alternative Actions (AA) to be taken, depending on the resolution to PSQ, are as follows:

- AA1: If the XRF spectrometer data indicate concentration of contaminants of concern detected in the soil in the study are greater than the PRG, an appropriate remedial action will be taken in that area.

- AA2: If the XRF spectrometer data indicate that none of the concentrations of contaminants of concern detected in the surface soil in the study are greater than the PRG, then no further action based on XRF spectrometer data will be recommended.

Combining the PSQ and AA resulted in the following Decision Statement (DS).

- DS: Using only XRF spectrometer data, determine whether or not surface soil concentrations in the study area indicate that the PRG of constituents of concern are exceeded, and if so what areas within the study are of concern.

3. Survey Methods

The XRF survey was designed to identify circular hot spots within an area of 1.0 ft^2 with a 9% chance of missing a hot spot that is present. The survey was performed using a NITON 703 Analyzer with the capabilities to detect lead and 14 elements in the soils. A laboratory performance evaluation soil sample, with a known concentration of lead, was obtained from the Radiological and Environmental Sciences Laboratory (RESL). This soil (RESL 95-S2) was analyzed by 37 laboratories and had a reported concentration from 238 to 329 mg/kg. The 95% confidence interval for the mean for this sample was 270 to 293 mg/kg. This soil was used as a standard for instrument evaluation and operational check. The standard was used to check initial calibration (automatically performed by the instrument during power-up) and after approximately every 20 field surveys.

The Transformer Yard was divided into 10 by 10 ft squares beginning at a point 70 feet north of the northeast corner of the building on a line parallel with the east side, as shown on Figure 1. The 10 by 10 ft grid was physically marked at the corner points using marking ribbon and nails. Ten-foot sections of plastic conduit were marked in 1.0 ft increments to demarcate the row and columns on a 1.0 by 1.0 ft grid (see Figure 2). The grid columns run north and south parallel to the building. The grid rows run east and west perpendicular to the building. The grid extended to the north from the building to ensure that the areas of loose gravel were not contaminated by windblown or other activities. Column BR was the furthest column surveyed to the east. Row 51 was the most northern row surveyed and, Row 195 was the furthest southern row.

Surveys began on October 16, 2000. To obtain the required detection sensitivity, a measurement was obtainable in 6.0 seconds on the NITON instrument (2.0 Nom Sec-This correlated to 6.0 seconds of exposure time and instrument response evaluation electronics). Actual measurement time was to 6.0 Nom. Sec on the instrument, which correlated to approximately 20 seconds in count time. Taking measurements for this duration allowed for a more accurate reading. Note in Figure 2 that the surface rocks had to be scraped off to perform the XRF survey.

Surveys were begun adjacent to the outside of the fence on grid columns A—J, rows 61 to 70. Three areas of contaminated soil (> 400 mg/kg) were found in this grid. They were in locations B70, C62, and a region at E66, F64, and G65. Other areas within the grid were generally above the instrument detection limit for lead in the soil but levels were well below the 400 mg/kg PRG.

The next grid surveyed was columns K—T, rows 61 to 67. (The north fence angles to the north east.) Two interesting observations were noted during this part of the survey. There was evidence of scrap metals consistent with the types seen within the fenced area of the yard, and two lead items were discovered, a piece of lead solder and a buried lead spatter of fair size (see Figure 3).

The completed survey of the north end identified high concentrations of lead in the columns H—K, rows 52 to 60 and at the site of N52. Close inspection identified that these were regions of apparent paint over spray (Figure 4). Many rocks in these areas exhibited yellow paint, which matched in shade and gloss the paint on a power pole tensioning cable cover (Figure 5).

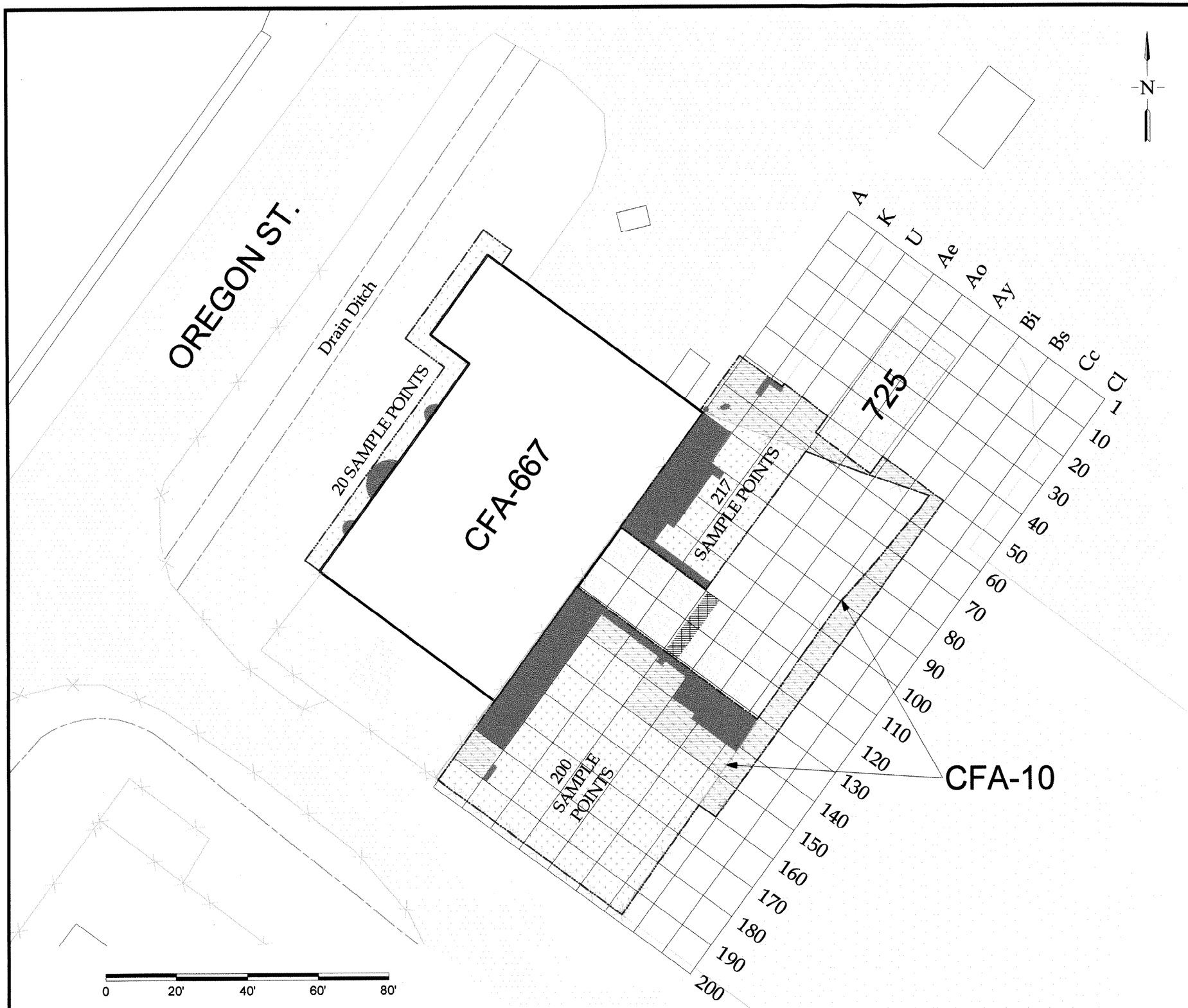

Figure 1. Map of CFA-10 showing physical features, contaminated areas, grid surveyed area and random surveyed area.

LEGEND

- ACTUAL SAMPLING AREA
- BUILDINGS AND PHYSICAL STRUCTURES
- FENCES
- DITCHES
- CONTAMINATED (> 400 mg/kg) (GRID SURVEYED)
- GRID SURVEY (~ 100 SAMPLE POINTS)
- RANDOM SURVEY (SAMPLE POINT NUMBER VARIED/10' x 10' AREA)
- GRAVEL
- PAVEMENT
- CONCRETE
- CEMENT

NOTES

APPROXIMATED ACTUAL SAMPLING AREA: 8,725 SQ. FT. (0.200 ACRES)

GRID SPACING: 10 FT. x 10 FT.

GRID SURVEY = 100 SAMPLE POINTS PER GRID

RANDOM SURVEY = RANGE OF 20 TO 1 SAMPLES PER GRID

REVISIONS

REV	DESCRIPTION	DATE	INIT
F	UPDATED PLAN VIEW PER DEBORAH WAGONER COMMENTS	02/09/01	KDS
E	UPDATED PLAN VIEW PER LORIN CLEMENTS COMMENTS	01/25/01	KDS
D	UPDATED PLAN VIEW PER LORIN CLEMENTS COMMENTS	11/20/00	KDS
C	UPDATED PLAN VIEW PER LORIN CLEMENTS COMMENTS	10/26/00	KDS

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CENTRAL FACILITES AREA
WAG 4 OU4-09
CFA-10 PLAN VIEW

FIGURE NUMBER: FIGURE 1

REVISION: F

SCALE: SHOWN

DATE: 10/04/00

RESEARCH: C. WATKINS

DRAWING: K. SESSIONS

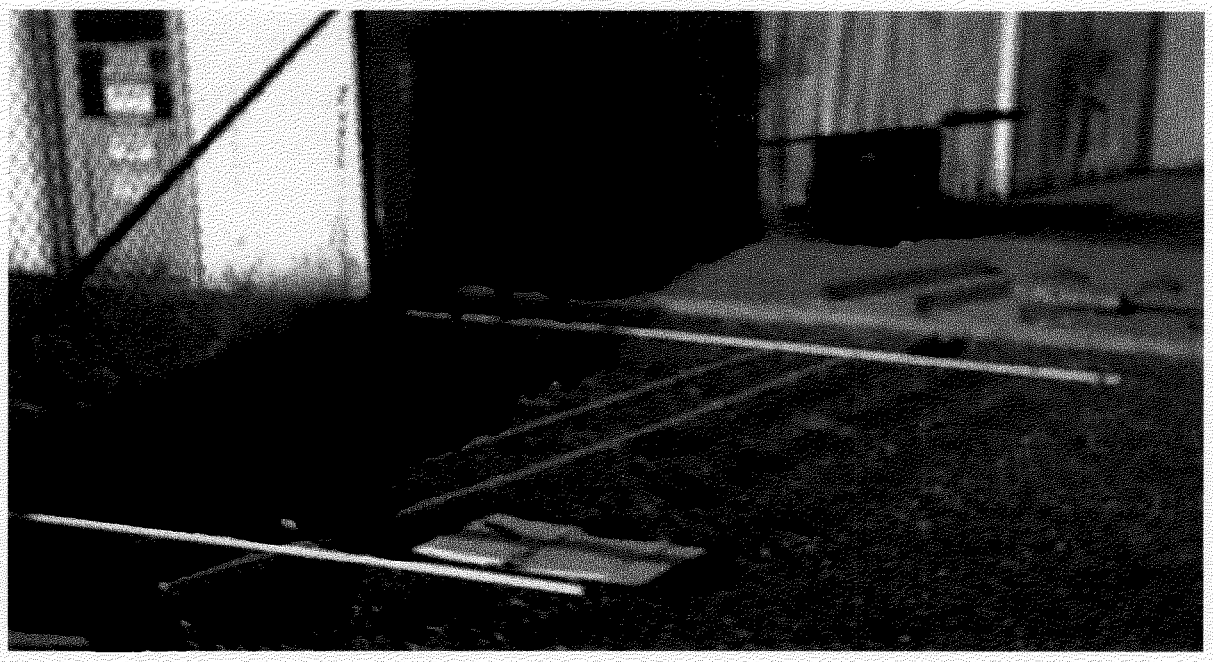

Figure 2. The northeast corner grid columns A—J, rows 61—70.

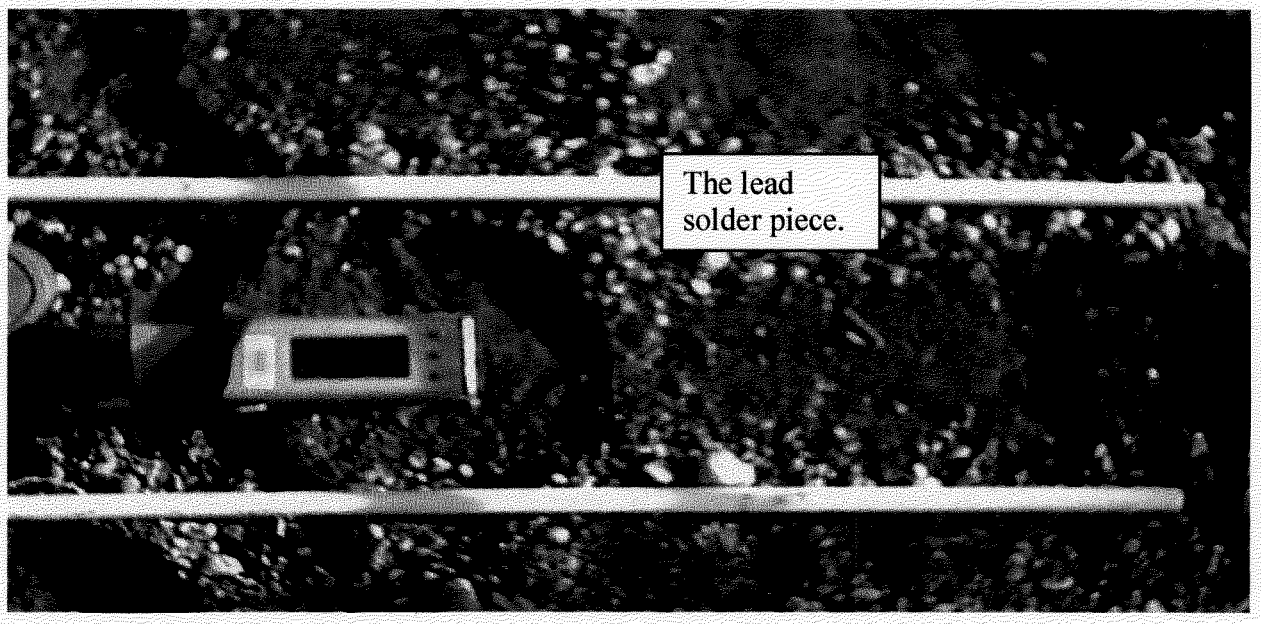

Figure 3. Lead solder buried in the dirt.

The other observation is that the north fence does not match the remaining yard fence. The south edge of the footing of the removed building may have been aligned with the north fence of the yard at some time (Figure 6). This would explain the presence of waste metals and solder in the soil outside of the existing fence boundary. Another source of lead contamination was identified in the form of yellow paint chips present in some areas. These paint chips, when segregated and analyzed separately, were found to be high in lead concentrations.

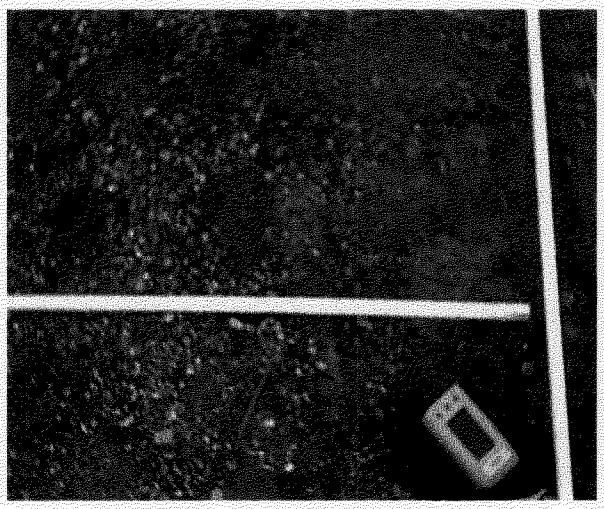

Figure 4. Yellow paint overspray on rocks.

Figure 5. Yellow painted cable guard.

Figure 6. The northern edge of the grid. Removed building slab shown.

Figure 7. Northeast corner of the fence, paint chips in this area.

Paint chips were identified between the fence and south part of the slab and also in the area of the forklift man basket shown in Figure 7. The yard east of the fence is used for heavy equipment temporary parking. On the day of the survey, a Fruehoff trailer with peeling yellow paint was noted. The paint chips are a different gloss and shade than the paint over spray on the rocks. The areas north of grid row 51 were not surveyed because they were either asphalt or in an area of disturbed surface. Also, columns U—Ad in rows 51 to 60 were all less than detectable on the NITON instrument. This indicates that the extent of the contamination had been reached.

Surveys along the east edge of the fence identified two things. First, soils contiguous to the fence do not contain elevated levels of lead above the proposed remediation goal. However, there are rocks in this area with yellow paint that are also high in lead concentrations. Second, one piece of lead was found outside of the fence partially buried in the soil (Figure 8). Soil beneath this piece of lead was high in lead content. The middle gate shows evidence of an object being painted with a similar high gloss yellow paint (Figure 9). It is assumed that grading of the parking lot for weed control has spread the rocks to the

north along the fence. There is evidence of grading and also an absence of yellow rocks to the south of the middle gate, which supports this assumption.

Figure 8. Lead partially buried at grid Bn72.

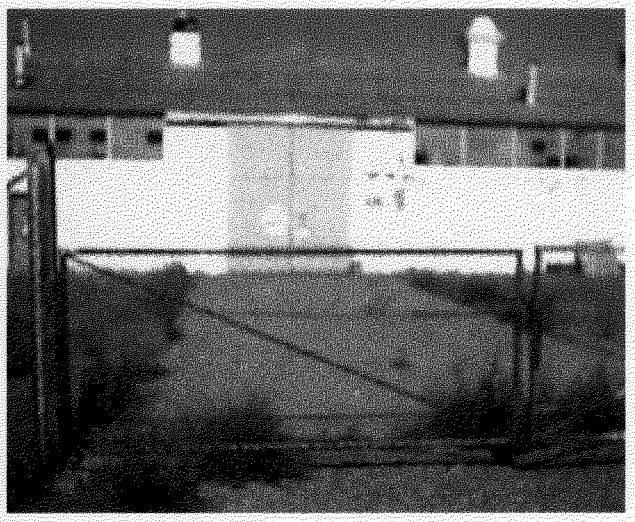

Figure 9. Yellow paint on right-hand gate.

The area from columns Ae to Bm and rows 131 to 144 (Figure 10) has a high concentration of visible lead metals. There are also areas with gray paint and yellow paint overspray on rocks. Because of the high concentrations of visible lead metals, these areas were not 100% surveyed. However, near to the lead as shown in Figure 11 the levels can still be less than 400 mg/kg. The readings near the lead in Bh141 and Bh142 (shown) were 628 and 520 mg /kg. One foot away the levels were less than 200 mg/kg in all directions. The measurements made at grid locations along the driveway from the grate to the building were consistently higher than the PRG. It was thought that the ditch might be more highly contaminated because of drainage, which did not turn out to be the case for surface soils. Measurements of surface soils under the grate ranged from 135 to 326 mg/kg. There is a large crack at the driveway to grate interface that may have high levels of lead in it, but the area was not accessible for survey.

Along the building in columns A to J, the survey yielded unexpected results. Along the total length of the building, from the footing to about 9.0 ft away and in some places greater than 9.0 ft, lead concentrations were consistently found to be many times the PRG (Figure 12). There was very little evidence of visible surface lead in this area except immediately adjacent to the driveway.

Figure 10. Area of concentrated surface lead.

Figure 11. Bh142 520 mg/kg near surface lead.

After determining the concentrations along the east side of the building it was thought that there might be a need to evaluate areas on the west side of the building. Twenty survey points were randomly selected along the west side of the building. Survey locations were measured using the southwest building corner as a reference location (Figure 13). Eighteen feet from the southwest corner and 1.0 ft from the building, a measurement of 478 mg/kg was recorded. At 30 ft from the southwest corner of the building and 1.0 ft from the building, the reading was 345 mg/kg. At 35 ft from the southwest corner of the building and 4.0 ft from the building, the reading was 691 mg/kg. At 58 ft from the southwest corner of the building and 4.0 ft from the building, the reading was 1,130 mg/kg.

Because project resources were limited, the south and east part of the yard were randomly surveyed. A total of 200 survey points were randomly field selected in these grids. As expected, the level of contamination decreased consistently as distance from the building increased. Many of the randomly selected points were measured at less than the instrument detection limit. The area north of the driveway between the building and the fence was not completely surveyed. Random points were field selected and surveyed. The 217 random locations were taken in an area bounded by the building to column Ad. These measurements identified a consistent pattern. Very high concentrations were measured at the roof drip line, and a probable snow melt zone. The concentrations of lead generally decreased as distance from the building increased. There are some areas of visible lead metals in this area and also small scrap metal zones. The area north of the driveway from the ditch to the fence was not surveyed. Areas where random

Figure 12. Contamination extends from about the bottom of the photo to the north end of the building.

Figure 13. CFA-667 west side, note the roof ventilators.

measurement locations were selected cannot be used to satisfy the statistical sampling designed specified in the survey plan. Circular hot spots of 1.0 ft^2 in size may exist in these areas and the probability of missing them (using a random sampling design) is much greater than 9%.

4. Summary

The survey identified very high levels of contamination adjacent to the building on either side of the concrete pad. The lead contamination in the yard is due to particles that range in size from large masses of welding solder to fine particulate in the soil. The measured contamination decreases in concentration as distance from the building increases. This is true in all instances except where large masses of visible lead are found. Contamination can be high immediately in the area of the visible lead metals. The measurement data and observations of visible surface contamination indicate that the area of the Transformer Yard was also probably more rectangular on the north end.

References:

[1] DOE-ID, 1999, *Comprehensive Remedial Investigation/Feasibility Study for the Central Facilities Area Operable Unit 4-13 At the Idaho National Engineering and Environmental Laboratory*, Revision 0, DOE/ID-10680, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, February.

[2]Contract K00-583020, Task No. 28 -XRF Survey

[3]Portage Environmental, Inc., 2000, *Data Collection Plan for the XRF Spectrometer Measurement Survey at WAG 4 OU 4-09 Site CFA-10 (Draft)*, Portage Environmental, Inc., Idaho Falls, Idaho, October 13.